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WITNESS my hand this
Twenty-sixth day of September 2000

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Patents Act 1990

PROVISIONAL SPECIFICATION

FOR THE INVENTION ENTITLED:

"PROVIDING OPERATING CAPABILITIES AT A TELECOMMUNICATIONS NETWORK NODE"

Applicant:

TELEFONAKTIEBOLAGET L M ERICSSON

The invention is described in the following statement:

PROVIDING OPERATING CAPABILITIES AT A TELECOMMUNICATIONS NETWORK NODE

This invention relates to a method of providing operating capabilities at a telecommunications network node, and more particularly relates to a method of providing operating capabilities at a telecommunications network node during a call set-up procedure between a mobile station in a mobile telecommunications network and a network element.

When a subscriber having a Mobile Station (MS) located in one Public Land Mobile Network (PLMN) which is to contact another subscriber having a mobile station located in another PLMN, the mobile station of the firstmentioned subscriber must transmit to its serving Mobile Switching Centre (MSC) a list of operating capabilities, such as a codec on which it is to transmit or security algorithms, negotiation over the operating capabilities to be used between the two mobile stations is then initiated, typically over a fixed switch network such as the PSTN, ISDN, IP or ATM. Once the capabilities are negotiated and agreed between the two mobile stations, then the call may proceed using those operating capabilities.

In one particular arrangement, developed by the present applicant, a Transport Independent Call Control (TICC) protocol is used for negotiating operating capabilities, and in particular codec negotiation. The TICC protocol is particularly suitable for third generation mobile networks, such as UMTS, wherein non-TDM transport technologies are used. However, the proposed TICC codec negotiation is not fully optimised for mobile environments. In particular, it is not optimised for fast selection of operating capabilities for mobile terminated calls when, for efficiency reasons, transcoders are placed in the edge of the core network at the GMSC.

The present invention seeks to overcome or substantially ameliorate any of the abovementioned disadvantages by providing a method of making available the list of operating capabilities to be used between a mobile station and a network node during a call set-up procedure between the mobile station and the network node.

Accordingly, the present invention provides a method of providing operating capabilities of a mobile station at a telecommunications network node to a telecommunications element during a call set-up procedure between the mobile

station and said telecommunications element, and wherein said telecommunications element transmits to the telecommunications network node a list of operating capabilities of the telecommunications element as part of the call set-up procedure, the method comprising the steps of:

transmitting a list of operating capabilities of said mobile station from a switching centre serving said mobile station to said telecommunication network node;

storing said list of operating capabilities at said telecommunications network node;

such that on initiation of a communication from said network element to said mobile station, said telecommunications network node internally selects one or more operating capabilities common to both the mobile station and the network element.

In this manner, the invention advantageously accelerates the selection of operating capabilities for mobile terminated calls wherein negotiation on the operating capabilities to be used between the mobile station and network node is no longer required at call set-up.

The network element is preferably another mobile station, but may alternatively be a telecommunications device or node. The list of operating capabilities of the mobile station may be transmitted to the network node in response to an information retrieval message sent from the network node to the switching centre. The list of operating capabilities of said mobile station may have been previously stored in a storage means, such as a VLR, associated with the switching centre serving the mobile station. The telecommunications network node may be a node located in the same telecommunications network or PLMN as the mobile station. The telecommunications network node may be a node located in a fixed network which is traversed in establishing a call between the network element and the mobile station. Alternatively the telecommunications network node may be a node of a different network to that where the mobile station is located and is preferably at the home network of the mobile station. The node, when located in one of the PLMNs is preferably a GMSC. The list of operating capabilities of both

the network element and the mobile station may be prioritised in the sense that preferred operating capabilities, such as codecs, are specified.

A list of operating capabilities of the network element may be stored at a network node serving the network of said network element. Preferably during the call set up the list of operating capabilities of the network element is transmitted from the network node serving the network of the network element to the telecommunications network node.

Thus, the selection of operating capabilities to be used is accelerated between the mobile station and the network element by the prior storage of the list of operating capabilities in the telecommunications network node. Codec operating capability negotiation need not take place as part of the call set-up between the mobile station and network element as the particular operator capabilities, such as codecs to be used, can be automatically selected by the telecommunications network node.

A preferred embodiment of the invention will hereinafter be described, by way of example only, with reference to the drawings wherein:

Figure 1 is a schematic diagram of a telecommunications system used in accordance with the present invention;

Figure 2 is a signalling diagram showing signalling messages that are passed between an originating mobile station and a destination mobile station using the telecommunications system of Figure 1;

Figure 3 is a signalling diagram showing the messages signalled between a switching centre serving a destination mobile station and a telecommunications network node, being in this case a GMSC located in a home network.

In Figure 1 there is shown a network element, hereinafter referred to as an originating mobile station 2 located in a first PLMN 4 which mobile station 2 is controlled by Base Station Controller or BSC 6. A Mobile Switching Centre (MSC) 10 directly controls or is linked to the BSC 6 and has an associated storage means in the form of a VLR 10. A GMSC 12 provides an interface between other networks such as a PSTN or ISDN 14. The GMSC 12 is directly linked to the MSC 8 and a further MSC 16 which has an associated VLR 18. Each of the VLRs store details of mobile subscribers and their mobile units that

are temporarily located within the serving area of the associated MSC. A further storage means 20 in the form of a Home Location Register (HLR) provides permanent storage of subscriber details and keeps continuous track of the location of a subscriber whether that subscriber is in an MSC service area or in a different PLMN. This information is used by the GMSC 12 when receiving a call from another network.

When the mobile station 2 wishes to initiate a communication or a call with a mobile station, hereinafter referred to as a destination mobile station, 22 located in a further PLMN 24, a list of operating capabilities of the originating mobile station 2 is already stored in the VLR 10 associated with the MSC 8 serving the mobile station 2. The destination mobile station 22 is serviced by base station controller 26 which in turn is linked to and controlled by MSC 28. Associated with the MSC 28 is a storage means in the form of a VLR 30 which stores a list of operating capabilities of the destination mobile station 22. The MSC 28 is linked directly to a GMSC 32 which in turn is linked to a further network such as the PSTN/ISDN 14. A set-up message is transmitted from mobile station 2 to the MSC 8. Thereafter an Initial Address Message (IAM) is sent from the MSC 8 to the GMSC 32 which may traverse other nodes such as the GMSC 12 and the fixed network 14. Included in this message are the operating capabilities, including the list of codecs that the MS 2 can use. At this stage on receipt by the GMSC 32 of the IAM from MSC 8, the GMSC 32 will send an information retrieval message in the form of a routing information retrieval signal to the MSC 28/VLR 30 requesting identification of the destination mobile station by the MSISDN or IMSI, in which case the MSC 28/VLR 30 will respond by sending the Mobile Subscriber Roaming Number (MSRN). This is sent back to the GMSC 32 for call routing purposes and a list of supported operating capabilities of the MS 22 is returned to the GMSC 32. The GMSC 32 is then in a position to select a codec or other operating capabilities for use and compatibility between the originating MS 2 and the destination MS 22. A further Initial Address Message or (IAM) is sent from the GMSC 32 to the MSC 28 including the selected codec whereupon a call is set up between the destination mobile station 22 and the originating mobile station 2. The list of supported operating

capabilities, including codecs, by the mobile station 22 is initially obtained from the VLR 30 for use in the return routing information retrieval message from the MSC 28 to the GMSC 32.

The MSC 8 or equivalently a TICC node has capability to separate an ISDN user part (ISUP) signal into a Call Control (CC) portion and a Bearer Control (BC) portion to where the call control portion of the ISUP carries the initial address message. By separating out the CC and BC portions via ISUP, the BC portion can allow the transmission at non-PCM levels particularly across the fixed network 14 which generally operates at 64 kbit/s. For example, channels only require 8 kbit/s or 16 kbit/s can be used so that when the MS 2 communicates with the MS 22, the selected codec may reflect the transmission at non-PCM levels such as 13 kbit/s for example.

Referring to Figure 2, the mobile station 2 in the originating PLMN 4 sets up the call through the set-up signal 34 which is received by the MSC 8. From there the MSC 8 sends an IAM 36 with a list of the operating capabilities of the MS 2, which may for example contain a list of codecs X, Y, Z that the MS 2 may use. This is transmitted to the GMSC 32, which by way of example is transmitted over a core network 14. The GMSC 32 then sends the routing information retrieval message 38 to the MSC 28/VLR 30 and when that signal is received a signal is returned to the GMSC 32 including the list of supported codecs and other operating capabilities of the mobile station 22. In this particular example these supported codecs are identified as X, Y and W. The GMSC 32 then selects an appropriate codec, in this example X, for use by both MS 2 and MS 22 and forwards an IAM 44 to the MSC 28 including the listed codec X and from there a set-up signal 42 is transmitted from the MSC 28 to the MS 22. At the same time the retrieval message 38 is being sent to the MSC 28, a call processing signal 46 is sent from the MSC 8 to the MS 2 so as to inform the MS 2 of progress of the call. A message 48, in the form of an application transport message (APM), containing the selected codec X is transmitted from GMSC 32 to the MSC 8 which in turn transmits a further progress call 50 to the MS 2 containing the selected codec X in this case. Radio Access Bearer (RAB) are then set up between the mobile stations and their respective MSCs at steps 52 and 54

respectively. An alert signal 56 is then sent from the destination MS 22 to the originating MS 2 as an in-band tone. On receipt of the alert message, the MS 2 responds by generating a ringing tone and if the subscriber of mobile station 22 answers, that MS sends a connect message at 58 to the MSC 28. The connection is then acknowledged by the MSC 28 in a return signal 60 to the MS 22 and then the MSC 28 forwards an answer message 62 to the GMSC 32 which is then forwarded at 64 on to the MSC 8. A connect message 66 is then transmitted from the MSC 8 to the MS unit 2 and connection is acknowledged by the MS to a signal 68 back to the MSC 8. Thereafter conversation can then take place between the two mobile subscribers.

With reference to Figure 3 the routing information retrieval message is sent by the GMSC 32 to the Home Location Register (HLR) 33 as a signal 70. This signal is sent using the Mobile Application Part (MAP) protocol and contains information requesting the identity of the mobile subscriber 22, such as the MSISDN or IMSI, from the HLR 33. The HLR 33 then forwards on a signal 72 using MAP to the visited network, in this case MSC 28 and VLR 30 of the MS 22. The signal 72 includes the request for the MS 22 to provide a roaming number or IMSI (International Mobile Subscriber Identity). Once received by the MSC 28 it responds with a signal 74 containing an acknowledgement of the signal 72 and transmits the mobile subscriber roaming number applicable to the MS 22 together with a list of operating capabilities, including a list of codecs, to be used by the MS 22. This list is retrieved from the VLR 30. That gets transmitted to the HLR 33 which in turn forwards a signal 76 to the GMSC 32 containing the routing information acknowledgement and the MSRN and the list of operating capabilities of the mobile station 22.

It will be appreciated that the list of operating capabilities included in the IAM 36 may be incorporated in the MAP message 70 sent from the GMSC 32 to the HLR 33, and then in the MAP message 72 from the HLR 33 to the MSC 28/VLR 30. The selected codec may then be returned to the GMSC 32 from the MSC 28/VLR 30 via MAP messages 74 and 76. In this case, codec selection takes place in the MSC 28/VLR 30.

Although this particular embodiment has been described with respect to a GSM network, the invention equally applies to third generation PLMN networks

and other second generation PLMN networks, having similar architectures. Furthermore the telecommunications network node in this preferred embodiment has been identified as GMSC 32. It may equally be a further GMSC 35 in the network identified as the home network of the destination mobile station 22. Alternatively it may be any other node in either a PLMN or a node located in the fixed network 14. Furthermore the call may not necessarily be established across a fixed network 14 but may be from one mobile network to another mobile network or the originating mobile station and destination mobile station may be located within the same PLMN.

With the foregoing description in mind, it is to be appreciated that the speed and efficiency at which operating capabilities, such as codecs and security algorithms, may be substantially accelerated from mobile terminated calls where a list of operating capabilities of the mobile station are stored at a selected telecommunications node such that the requirement for negotiating operating capabilities out of band towards the terminating mobile station is substantially reduced or not needed at all. Furthermore the GMSC serving the originating mobile station may have forwarded to it a list of operating capabilities of the originating mobile station or network element which is sent from the designated VLR associated with the originating mobile station or network element.

It will also be appreciated that various modifications and alterations may be made to the preferred embodiments above, without departing from the scope and spirit of the present invention.

DATED: 30 July 1999

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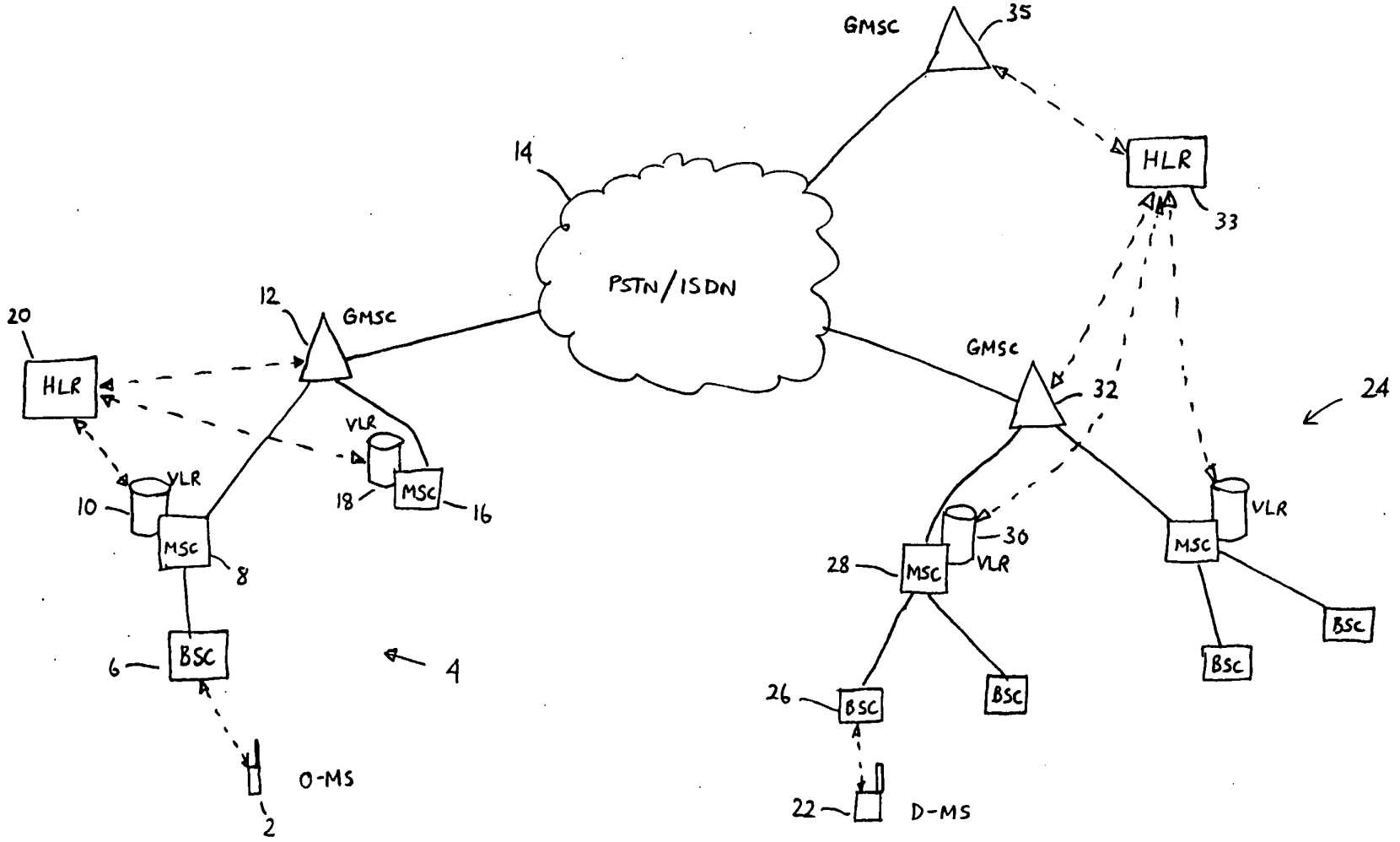
Patent Attorneys for the Applicants:

TELEFONAKTIEBOLAGET L M ERICSSON


GMSC
35
14
HLR
33
PSTN/ISDN
12
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HLR
GMSC
32
24
VLR
18
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16
VLR
10
MSC
8
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30
28
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22
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FIGURE 1

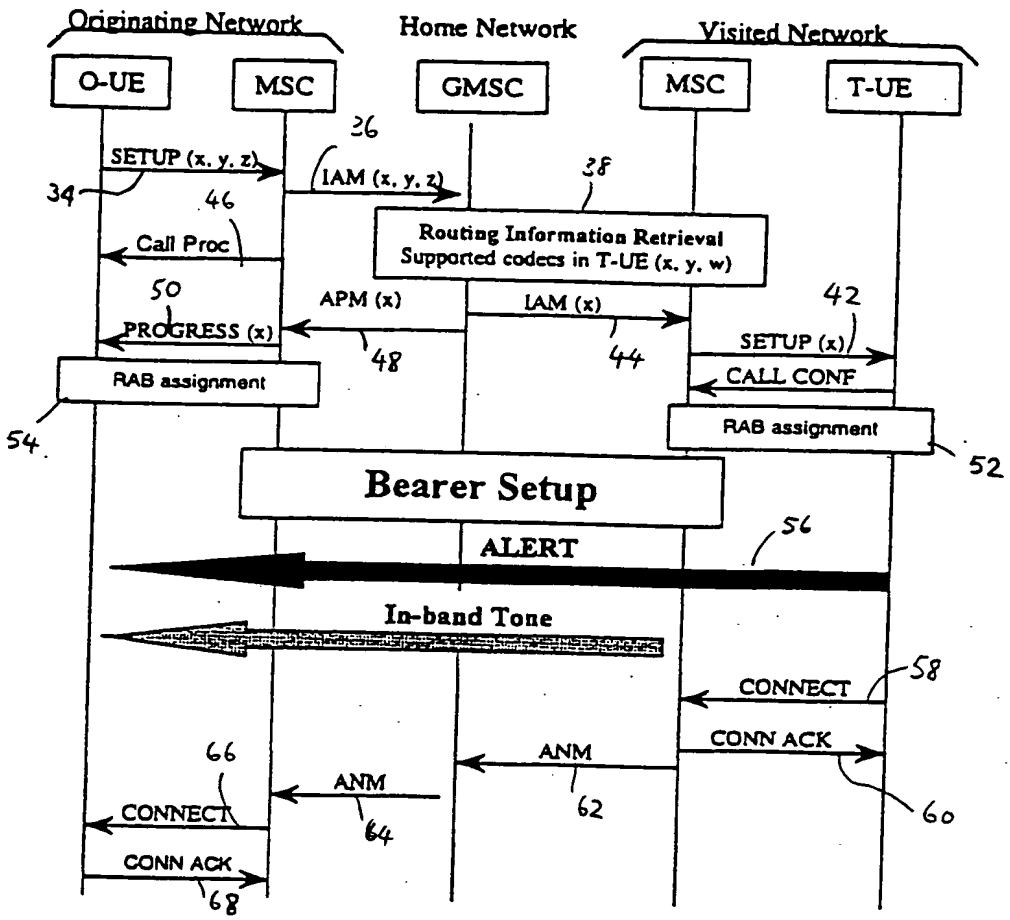

FIGURE 2

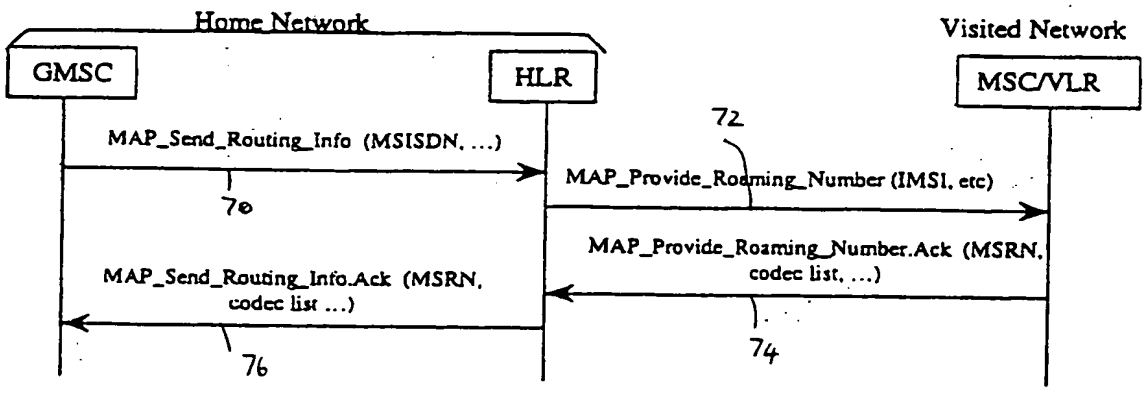

FIGURE 3